

CONNECTICUT COASTAL BASIN
CLINTON, CONNECTICUT

BOULDER LAKE DAM CT 00518

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM



**DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154**

JULY 1981

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Boulder Lake Dam is an earthfill embankment with a rubble stone and boulder faced wall on the downstream side. Approximately 130 ft. long, the dam has a maximum height of 14 ft. and a top width varying from 10 to 12 ft. Based on the visual inspection, the Boulder Lake Dam is generally in fair condition. It is classified as 'Small' in size with 'Low' hazard potential. A test flood equal to 100 year event was selected in accordance with the Corps of Engineers.		

BOULDER LAKE DAM

CT 00518

CONNECTICUT COASTAL BASIN

CLINTON, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

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PHASE I INSPECTION REPORT

IDENTIFICATION NO: CT-00518
NAME OF DAM: Boulder Lake Dam
TOWN: Clinton
COUNTY AND STATE: Middlesex County, Connecticut
STREAM: Un-named tributary of Hammonasset River
DATE OF INSPECTION: June 2, 1981

BRIEF ASSESSMENT

Boulder Lake Dam is an earthfill embankment with a rubble stone and boulder faced wall on the downstream side. Approximately 130 ft. long, the dam has a maximum height of 14 ft. and a top width varying from 10 to 12 ft. The normal flow spillway is a notched 5 ft. wide section whereas a low concrete formation extending 13 ft. east and 26 ft. west of this spillway acts as an overflow weir during high water conditions. The total length of the overflow section including the spillway is accordingly 44 ft. In addition, the earth embankment to the east, with a rubble stone and boulder downstream face also passes part of the flood flow during high water conditions.

Based on the visual inspection, the Boulder Lake Dam is generally in fair condition. Several areas of concern were observed requiring monitoring, maintenance and/or repair. Some features found existing that could affect the stability of the dam are: loosely compacted sand on the crest of the dam embankment; sand bags piled on the crest of the dam over its eastern section, which could deteriorate with time; and inadequate spillway capacity.

As per the Corps of Engineers' Recommended Guidelines for Safety Inspection of dams, the Boulder Lake Dam is classified as 'Small' in size with 'Low' hazard potential. A test flood equal to 100 year event was selected in accordance with the Corps of Engineers' Guidelines. The calculated test flood inflow of 150 cfs was used in the analysis to assess the spillway capacity. Routing of the test flood inflow did not alter the outflow significantly due to the small surcharge storage.

The spillway capacity of the 5' notched spillway section together with the 39' overflow dam section is 66 cfs which is only 44% of the test flood flow. In order to pass the balance of test flood, the east portion of the dam would also serve as an overflow section. The storage capacity of the reservoir at the top of the dam is 55 ac. ft.

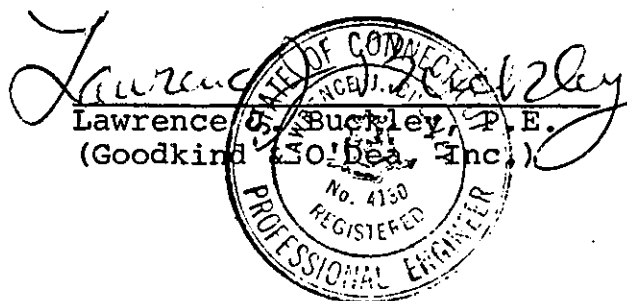
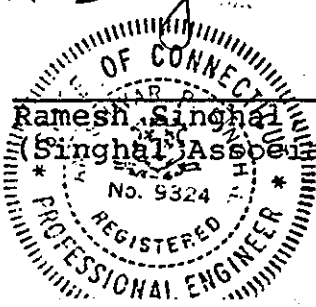
The following measures should be undertaken by the owner to ensure the stability of the structure:

Provide adequate protection along the crest of the dam to prevent scour and erosion; remove trees on the crest of the dam at the west end embankment; monitor the seepage areas at the dam embankment and the toe on downstream side; arrange continuous surveillance of the dam during periods of heavy precipitation and runoff.

GOODKIND & O'DEA, INC.
AND
SINGHAL ASSOCIATES
(J.V.)

R. Singh

Ramesh Singh, Ph.D., P.E.
(Singhal Associates)



PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the

present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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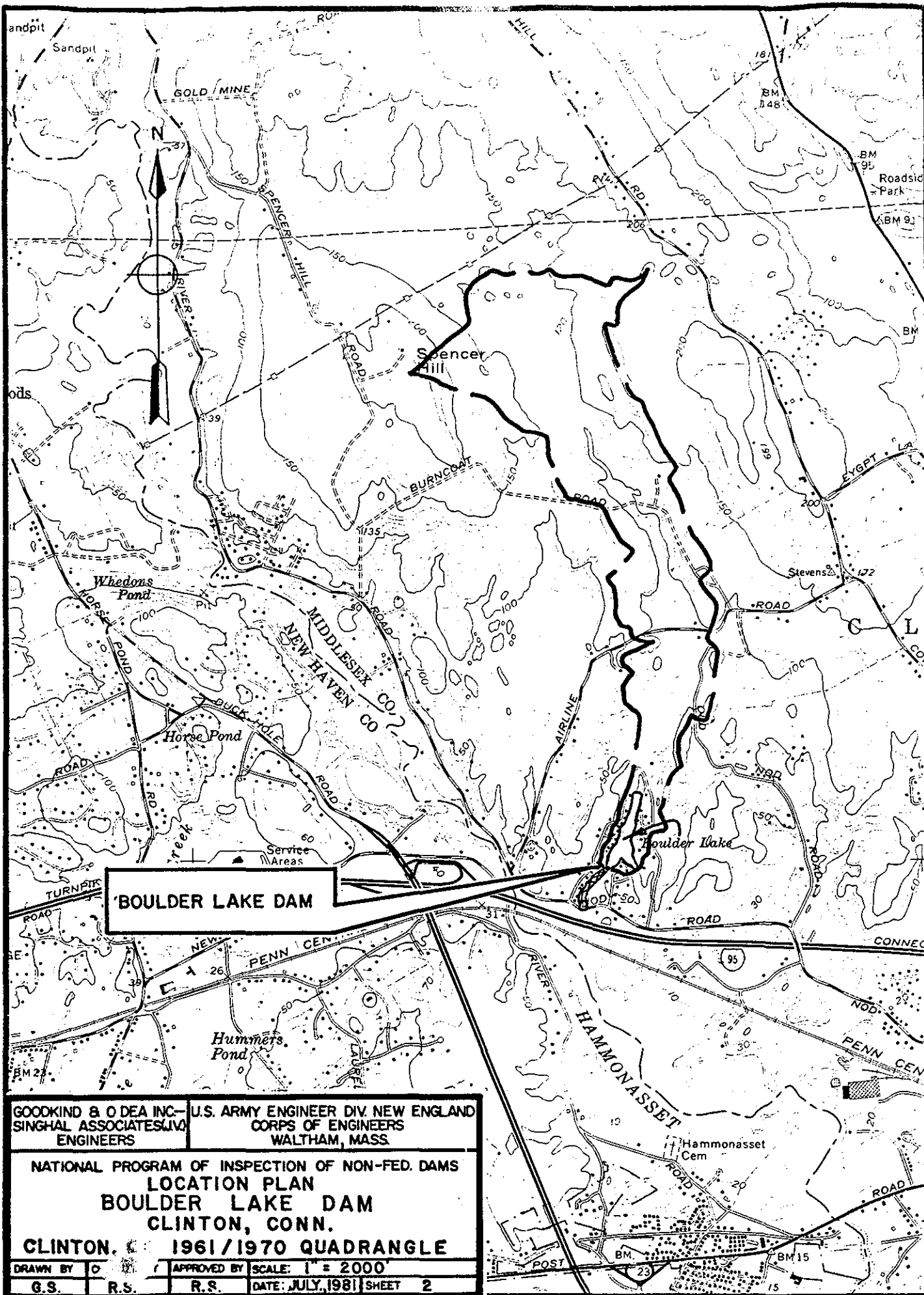
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NOTE:

OVERVIEW PHOTO TAKEN JUNE 2, 1981.

GOODKIND & O'DEA INC.- SINGHAL ASSOCIATES (JV) ENGINEERS		U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
OVERVIEW PHOTO OF DAM			
BOULDER LAKE DAM			
CLINTON, CONNECTICUT			
DRAWN BY	CHECKED BY	APPROVED BY	SCALE: NONE
E.T.K.	W.J.W.	L.J.B.	DATE: JULY 1981
			SHEET 1



GOODKIND & O'DEA INC.-
SINGHAL ASSOCIATES/JVA
ENGINEERS

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
LOCATION PLAN
BOULDER LAKE DAM
CLINTON, CONN.

CLINTON, CT 1961/1970 QUADRANGLE

DRAWN BY
G.S.

R.S.

APPROVED BY
R.S.

SCALE: 1" = 2000'

DATE: JULY, 1981 SHEET 2

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

PROJECT INFORMATION
Section 1

1.1 GENERAL

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Goodkind & O'Dea Inc., Hamden, Conn. and Singhal Associates, Orange, Conn. (Joint Venture) have been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Goodkind & O'Dea Inc. and Singhal Associates (J.V.) under a letter of June 22, 1981 from Colonel William E. Hodgson, Jr., Corps of Engineers. Contract No. DACW 33-81-C-0022 dated December 9, 1980 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interest.

2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.
3. To update, verify and complete the National Inventory of Dams.

1.2 DESCRIPTION OF PROJECT

a. Location

The Boulder Lake Dam is situated on an unnamed tributary of Hammonasset River. The confluence with Hammonasset River is approximately 1200 ft. downstream. Location of the project is approximately 1500 ft. east of the intersection of Nod Road and Airline Road and 1000 ft. north of the Connecticut Turnpike (Inter-State Route 95). The geographic location of the site may be found on the Clinton Quadrangle Map, having coordinates of latitude $N41^{\circ}-17.5'$ and longitude $W72^{\circ}-33.6'$.

b. Description of Dam and Appurtenant Structures

Boulder Lake Dam is an earthfill embankment approximately 130 ft. long, with a rubbled stone and boulder face wall on the downstream side. Top width of the dam varies from 10 to 12 ft. and generally consists of a loosely compacted sand cover. The crest elevation varies from 36.4' to 37.5' with a maximum height of 14 ft. (All elevations in report are referenced to Mean Sea Level). The upstream slope of the dam varies from 3 horizontal to 1 vertical, to 5 horizontal to 1 vertical. The downstream slope of the rubble stone wall varies from 1/2 horizontal to 1 vertical, to 3/4 horizontal to 1 vertical.

Located at the west end of the dam, is a 5' wide notched spillway at a crest elevation of 36.1'. A low concrete formation extends 13 ft. east and 26 ft. west of the notched spillway and serves as an overflow weir during high water conditions. As indicated on the general plan in Appendix B, the top width of this concrete structures varies from 1.8 to 2.5 ft. and is approximately 5 inches above the notched spillway crest.

c. Size classification: 'Small'

According to the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, a dam is classified 'small' if either its height lies between 25 ft. and 40 ft. or the storage is between 50 ac. ft. and 1000 ac. ft., or both. The Boulder Lake Dam has a maximum height of only 14 ft. but the maximum storage is 51 ac. ft. As such it is classified as 'small' in size.

d. Hazard classification: 'Low'

Based on the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, the hazard classification for Boulder Lake Dam is 'low'. A dam failure analysis indicates that a breach of the dam would result in a downstream flood flow of approximately 4,600 cfs, causing a 7 ft. high wave of water to travel down the brook. Continuation of the valley flood routing shows that at the second cross section located 675 ft. downstream from the dam, the excess flow and wave heights are 4600 cfs and 6 ft. respectively.

In the event of dam failure, there will not be any flooding of houses on the downstream side. Therefore, the dam is classified as a 'low' hazard potential.

e. Ownership

The Boulder Lake Dam and Lake are owned by:

Boulder Lake Improvement Associates Inc.
36 West Shore Drive
Clinton, Conn. 06413

f. Operator

Mr. James L. Marini
President, Boulder Lake Improvement Associates Inc.
36 West Shore Drive
Clinton, Conn. 06413
Telephone: (203) 669-7525

g. Purpose of Dam

The Boulder Lake and Dam are used for recreational purposes.

h. Design and Construction History

There are no records of design and construction history of the lake and the dam. The main structure that presently exists, was built in the late 1940's.

i. Normal Operational Procedures

Operational procedures for the project generally consists of monitoring and surveillance during periods of heavy runoff.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area consists of 0.5 sq. miles of moderately sloping terrain, with an average slope of approximately 1.4%, and ground elevations ranging from 35 to 150 MSL. The area is lightly populated with four or five town roads passing through it.

b. Discharge at Damsite

Discharge from the impoundment occurs over a 44 ft. long spillway section, including the 5 ft. notched spillway and the 39 ft. concrete weir formation. Only 44% of the test flood can pass through this overflow section; therefore the additional flow passes over the east portion of the dam embankment.

1. Outlet works	N/A
2. Maximum known flood at damsite:	Unknown
3. Ungated spillway capacity at top of dam elevation:	66 cfs 37.1
4. Ungated spillway capacity at test flood elevation 37.5:	150 cfs
5. Gated spillway capacity at normal pool elevation:	N/A
6. Gated spillway capacity at test flood elevation:	N/A
7. Total spillway capacity at test flood elevation 37.5:	150 cfs
8. Total project discharge at top of dam elevation 37.1:	66 cfs
9. Total project discharge at test flood elevation 37.5 :	150 cfs

c. Elevation (NGVD)

1. Streambed at toe of Dam:	26.3
2. Bottom of Cutoff:	N/A
3. Maximum tailwater:	27.6
4. Recreation Pool:	36.2
5. Full flood control pool:	36.1
6. Spillway crest:	36.1
7. Design surcharge original design:	N/A

8. Top of dam:	varies from 36.4 to 37.5
9. Test flood surcharge:	37.5
d. <u>Reservoir - length in Feet</u>	
1. Normal pool:	1300
2. Flood control pool:	1300
3. Spillway crest pool:	1300
4. Top of Dam:	1325
5. Test flood pool:	1350
e. <u>Storage (Acre - feet)</u>	
1. Normal pool:	51
2. Flood control pool:	51
3. Spillway crest pool:	51
4. Top of dam:	55
5. Test flood pool:	60
f. <u>Reservoir Surface - Acres</u>	
1. Normal pool:	5.9
2. Flood control pool:	5.9
3. Spillway crest pool:	5.9
4. Top of dam:	6.2
5. Test flood pool:	6.35
g. <u>Dam</u>	
1. Type:	Stonewall - earth embankment
2. Length:	130'
3. Height:	14 ft. (maximum)
4. Top width:	varies from 10 to 12 ft.
5. Side slopes:	3 hor. to 1 vert. to 5 hor. to 1 vert.

U/S

	D/S	1/2 hor. to 1 vert. to 3/4 hor. to 1 vert.
6. Zoning:		Dam consists of a combination of stone wall and earth embankment.
7. Impervious core:		N/A
8. Cutoff:		N/A
9. Grout curtain:		N/A
10. Other:		-
h. <u>Diversion and Regulating Tunnel:</u>		N/A
i. <u>Spillway</u>		
1. Type		Concrete weir of the dam with a narrow spillway cut.
2. Length of crest		44 ft. long overflow section including 5' wide spillway cut
3. Crest elevation:		Spillway cut: 36.1 Concrete Overflow weir: 36.4
4. Gates:		N/A
5. Upstream channel:		Boulder Lake
6. Downstream channel:		Natural brook
7. General:		--
j. <u>Regulating Outlets</u>		N/A

ENGINEERING DATA
Section 2

2.1 Design Data

There are no available design plans or computations.

2.2 Construction Data

No construction data are available.

2.3 Operational Data

Data pertaining to the operations of the project are not available.

2.4 Evaluation of Data

a. Availability

There are no available engineering data.

b. Adequacy

The engineering data available are inadequate to be of any assistance in the evaluation of the dam.

c. Validity

Due to the absence of engineering data, the validity of the data cannot be assessed.

VISUAL INSPECTION
Section 3

3.1 Findings

a. General

On June 2, 1981, engineers from Goodkind & O'Dea, Inc. and Singhal Associates, performed a formal field inspection of Boulder Lake Dam. Detailed checklists, included in the Appendix A, aided in the inspection of the dam and spillway. These checklists were supplemented with photographs of the project and problem areas, which are given in Appendix C with the photo location plan.

Boulder Lake Dam is in fair condition with areas requiring maintenance, repair and/or monitoring. At the time of the inspection, there was a light rainfall and the lake level was approximately 36.2 ft, which is one-tenth of a foot above the spillway crest elevation.

b. Dam

The dam is primarily an earthfill embankment with a rubbled stone and boulder faced wall on the downstream side. As shown in Photos 1 and 2, the crest of the dam consists of sand and gravel areas with several sand bags east of the spillway. Susceptible to erosion, the sand covered portion of the crest is loosely compacted, serving as a beach area to the lake (see Photo 3). The sand bags in conjunction with a low concrete block wall retain sand fill, deterring erosion in the vicinity of the spillway.

Varying in width from 1.5 ft. to 2.5 ft., a low concrete formation extending 13 ft. east and 26 ft. west of the notched spillway acts as an overflow weir during high water conditions. Immediately downstream of this structure the crest area is covered with large gravel up to 3 inches in diameter (see Photo 2). As indicated in Photos 1 and 4, a six inch tree and a twin 2 inch and 10 inch tree are also located in this area and are overhanging the concrete spillway.

The sand and earthfill embankment is retained by a rubbled stone and boulder wall (see Photos 4 and 5). Sloping outward, the wall appeared stable with no indication of missing stones. Grass and weed vegetation and a tree stump were noted to be growing and protruding respectively from the rubbled embankment as shown in Photos 4 and 5. Three areas of seepage were visible at the toe of the dam embankment, as noted on the general plan in Appendix B. Varying from approximately one to several gallons per minute, the seepage flows were clean with no evidence of piping. Iron oxide deposits were observed at all three seepage areas, possibly resulting from upstream septic systems. Located at the east end of the dam, a 6 inch hole with standing water was observed at the embankment toe (see general plan in Appendix B). Such a condition indicates that seepage may exist through and/or under the dam embankment.

c. Appurtenant Structures

Spillway

The normal outflow from Boulder Lake passes through the notched concrete spillway at the west end of the dam.

Approximately five feet wide, the spillway was in good condition with no evidence of concrete cracking or spalling. Water flowing over the spillway obscured the downstream concrete face preventing a close inspection. A six inch pipe which was utilized as an outlet during the construction of the dam is located at the base of the spillway face and is presently sealed and inoperable.

In addition to the narrow notched spillway, there are two low concrete structures which serve as overflow weirs under high water conditions (see general plan in Appendix B). Approximately 4 inches above the notched spillway crest, the weirs were in good condition with no indication of cracking or spalling. A steel piped rail extends along the eastern section of the structure across the normal flow spillway as shown in Photo 2.

Primarily consisting of a loose gravel and sand mixture, the approach area to this overflow weir will be susceptible to erosion and scouring during high flow conditions. The large gravel and the rubble embankment downstream of the weir partially protect the dam from such flow related problems.

d. Reservoir Area

Boulder Lake is a small reservoir primarily utilized for recreational purposes, such as swimming and boating. Numerous residential homes are located along the periphery of the lake, which is heavily wooded. As shown in Photos 1 and 6, numerous rock outcroppings and large boulders fringe the reservoir area providing for a stable shoreline.

e. Downstream Channel

The brook downstream from the dam generally consists

of large boulders and rocks scattered along the channel floor. Numerous trees overhang this downstream area which is heavily overgrown with various sized vegetation.

3.2 Evaluation

Boulder Lake Dam is generally in fair condition as assessed by the visual inspection. Several areas of concern were observed requiring monitoring, maintenance and/or repair. The seepage areas and standing water noted at the toe of the downstream rubble wall gave no indication of piping of solids and do not present a serious problem at this time. Monitoring of these areas is recommended to ensure the structural stability of the dam. Another area of concern was the loosely compacted sand on the crest of the dam embankment. Due to the minimal freeboard of the dam and the inadequate spillway capacity, the crest is susceptible to scouring under high water conditions. In addition to the sand on the crest, the sand bags just east of the concrete overflow weir presents a future problem. These sand bags are a temporary means of increasing the dam's freeboard and deterring erosion of the crest. In time, they will deteriorate, thereby increasing the likelihood of erosion and scouring, especially during periods of heavy precipitation.

OPERATIONAL AND MAINTENANCE PROCEDURES

Section 4

4.1 Operational Procedures

a. General

The operational procedures for Boulder Lake Dam generally consist of surveillance of the project at times of heavy runoff. Since the dam has very little freeboard, local residents inspect the site at these times to monitor the problem areas.

Lake level readings are not taken nor is there a regulating outlet to be operated.

b. Description of any Warning Systems in Effect

There are no warning systems in effect and, since the dam is a low hazard project, such a plan is not necessitated at this time.

4.2 Maintenance Procedures

a. General

The Boulder Lake Improvement Association is responsible for the maintenance of the project. Maintenance procedures generally consist of superficial repairs to the dam crest and replacement of stones at the rubble downstream embankment. Routine inspections of the project occur by local members of the Association who monitor seepage areas and inspect the dam embankment. Records of these inspections are not kept; however, copies of several reports and correspondence referring to the condition of the project in the past are included in Appendix B.

b. Operating Facilities

Since no regulating outlet exists at the project, maintenance procedures for such is not required.

4.3 Evaluation

Operational and maintenance procedures for Boulder Lake Dam are generally sufficient considering its small size and low hazard classification. The routine monitoring and inspection of the project was initiated as a result of orders from the State of Connecticut Department of Environmental Protection to improve the condition of the project (see correspondence in Appendix B).

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES
SECTION 5

5.1 GENERAL

The Boulder Lake has a contributory drainage area of 0.5 square miles which is gently sloping at an average slope of 1.4%. The area is lightly populated with four or five town roads passing through it.

The spillway notch is only 5 ft. wide with a maximum capacity of 3 cfs. The overflow section of the dam, approximately 44 ft. long, including the spillway notch, will pass up to 66 cfs with water surface elevation rising a foot over the concrete weir section. The spillway capacity of 66 cfs is only 44% of the design test flood which is 150 cfs. Under test flood conditions, the water level will rise to elevation 37.5' which is 1.4 ft. above the spillway crest elevation. The overflow section of the dam will be overtopped by 12" and the dam section east of the spillway by approximately 6".

5.2 Design Data

No design data are available. The dam has been overtopped on several occasions in the past - Most recently in January 1979 when several leaks developed in the embankment. Some repairs were subsequently done by the Boulder Lake Association.

5.3 Experience Data

No records are kept of lake elevations or other pertinent data.

5.4 Test Flood Analysis

Based on dam failure analysis, the Boulder Lake Dam is classified as being 'low' hazard potential in accordance with Table 2 on page D-9 of the Corps of Engineer's Recommended Guidelines for Safety Inspection of Dams.

The recommended test flood is 50 to 100 year frequency event.

The soil conservation service method gives the 100 year frequency flood as 150 cfs while, according to 'A flood flow formula for Connecticut' (Geol. Survey circular 365),

$$\begin{aligned} Q_{100} &= 5 \times 0.85 AS \\ &= 5 \times 0.85 \times 0.5 \times 52.8 = 155 \text{ cfs} \end{aligned}$$

Test flood was assumed as 150 cfs.

The surcharge storage capacity of the Boulder Lake being small, does not result in a substantial reduction of flow due to routing, and the inflow rate of 150 cfs was used to calculate the extent of overtopping. The spillway capacity of the overflow section is 66 cfs which is only 44% of the test flood flow.

5.5 Dam Failure Analysis

A dam failure analysis was made using the guidelines established by the Corps of Engineers. Failure of the dam was

assumed with water level at elevation 37.1 and a pre-failure flow of 150 cfs. Assuming a dam breach 52 ft. wide and 14 ft. high, the peak release rate into the downstream valley will be 4,600 cfs.

The height of the flood wave was about 7 ft. at the first cross-section (sta. 2+50). At the second cross-section 425 ft. downstream (sta. 6+75), the flood wave depth was approximately 6 ft. Flood routing computations were done taking into consideration the available valley storage. The resulting flood elevations and the values of routed flood flow are shown in Appendix D which also gives the routed flows and flood elevations for the test flood, assuming no failure. The two sets of flood depths are tabulated below:

	<u>Q</u> <u>(cfs)</u>	<u>Flow depth ft.</u>	
		<u>Sta. 2+50</u>	<u>Sta. 6+75</u>
Test flood condition (no dam failure)	150	1.3	1.7
Dam Failure condition	4,600	6.8	6.3

The analysis shows that there will be no additional flood hazard caused by dam failure. Also under the test flood condition, there is no likelihood of any houses being flooded. The dam is therefore classified as "low" hazard potential.

EVALUATION OF STRUCTURAL STABILITY
Section 6

6.1 Visual Observations

Although the visual inspection revealed no structural stability problems, an area of concern was noted. Insufficient freeboard to the top of dam in conjunction with the inadequacy of the spillway subjects the sand covered crest to scouring and erosion during periods of heavy rainfall. Such a condition could have an adverse effect on the stability of the dam.

Seepage areas noted at the toe of the dam embankment showed no signs of piping material. These areas are being monitored by the association and do not present a problem at this time.

6.2 Design and Construction Data

There are no available design or construction plans or reports for Boulder Lake Dam; however, information concerning the construction history of the dam was collected through a conversation with a local contractor who constructed the present embankment. The contractor placed a maximum of eight to ten feet of fill over a foundation consisting of bedrock outcroppings and large boulders. Fill quantities required toward the abutments were considerably less due to the higher bedrock outcroppings.

6.3 Post Construction Changes

The existing concrete spillway and the overflow weir were constructed at an unknown date following completion of the main embankment.

In January 1979, a severe leak developed at a point 32 feet east of the spillway. Sand bags and plywood sheathing were temporarily installed to control the leakage. Eventually the

aperture was grouted and backfilled with gravel and sand. In addition, several concrete blocks were removed at the east end of the concrete overflow weir to increase the spillway capacity.

6.4 Seismic Stability

The dam is located in Seismic Zone 1 and in accordance with Corps of Engineers' guidelines, does not warrant further seismic analysis at this time.

ASSESSMENT AND REMEDIAL MEASURES
Section 7

7.1 Project Assessment

a. Condition

As assessed by the visual inspection of the site and the past performance, the project appears to be in fair condition. Observations revealed no structural stability problems; however, there are areas of concern requiring maintenance, repair work and/or monitoring as noted in Section 7.2.

Based upon the "Preliminary Guidance for Estimating Maximum Probable Discharge" dated March, 1978, peak inflow to the reservoir is 150 cfs; peak outflow is 150 cfs, with the water level 0.5 feet above the top of dam. With the lake level to the crest of the dam, the total spillway capacity, including the overflow weir, is 66 cfs, which is equivalent to 44% of the routed test flood outflow.

b. Adequacy of Information

The information available is such that an assessment of the condition and stability of the project was based primarily on the visual inspection.

c. Urgency

It is recommended that the measures presented in Section 7.2 be implemented within one year of the owner's receipt of this report.

7.2 Remedial Measures

a. Operation and Maintenance Procedures

The following measures should be undertaken within the time period indicated in Section 7.1.c, and continued on a regular

basis.

1. Surveillance of the dam during periods of heavy precipitation.
2. Monitoring of the seepage areas noted at the dam embankment.
3. Remove trees on crest at west end of dam embankment.
4. Provide adequate protection along crest of dam to prevent erosion and scouring.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Boulder Lake Dam

DATE 6/2/81

TIME Morning

WEATHER Rainy, 70's

W.S. ELEV. 36.1 U.S. 27[±] DN.S.
(MSL)

PARTY:

1. Wesley J Wolf (WW)
2. Larry J. Buckley (LB)
3. Ramesh F. Singhal (RS)
4. Gerald F. Buckley (GB)
5. Glenn Scallia (GS)

DISCIPLINE:

- Hydraulics & Survey
- Geotechnical
- Hydraulics
- Soils & Structures
- Structures

PROJECT FEATURE

INSPECTED BY

- | | |
|--------------------------|---------------------------|
| 1. <u>Dam Foundation</u> | <u>WW, LB, RS, GB, GS</u> |
| 2. <u>Spillway</u> | <u>WW, LB, RS, GB, GS</u> |
| 3. _____ | _____ |
| 4. _____ | _____ |
| 5. _____ | _____ |
| 6. _____ | _____ |
| 7. _____ | _____ |
| 8. _____ | _____ |
| 9. _____ | _____ |
| 10. _____ | _____ |

PERIODIC INSPECTION CHECK LIST

PROJECT Boulder Lake Dam DATE June 2, 1981
 PROJECT FEATURE Dam Embankment NAME WW, LB, RS, GS, GB
 DISCIPLINE _____ NAME _____

AREA ELEVATED	CONDITIONS
<u>DAM EMBANKMENT</u>	Earth embankment with rubbled stone & boulder D/S face.
Crest Elevation	36.7' (MSL) Varies
Current Pool Elevation	36.2' (MSL)
Maximum Impoundment to Date	Unknown
Surface Cracks	None Observed
Pavement Conditions	N/A
Movement or settlement of crest	Irregular Crest - Sand Cover (no vegetation)
Lateral movement	None Observed
Vertical alignment	O.K.
Horizontal alignment	O.K.
Conditions at abutment & at Concrete Structures	O.K. Concrete in good condition
Indications of Movement of Structural Items on Slopes	N/A
Trespassing on Slopes	U/S - Beach area
Sloughing or Erosion of Slopes or Abutments	None
Rock Slope Protection-Riprap Failures	N/A
Unusual Movement or Cracking at or Near Toes	None Observed
Unusual Embankment or Downstream Seepage	Downstream seepage at toe of dam in 3 areas *
Piping or Boils	None Observed
Foundation Drainage Features	N/A
Toe Drains	N/A
Instrumentation System	N/A

A-2 * Iron Oxide Deposits. Little
reason for concern

PERIODIC INSPECTION CHECK LIST

PROJECT Boulder Lake Dam DATE June 2, 1981
 PROJECT FEATURE Spillway NAME WW, LR, RS, GB, GS
 DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	5' wide Concrete Spillway *
a. Approach Channel	Boulder Lake is the approach channel
General Condition	None
Loose rock overhanging channel	None
Trees Overhanging Channel	Twin Tree (2" dia) and 2" dia
Floor of Approach Channel	Good bottom O.K.
b. Weir and trailing walls	
General Condition of Concrete	O.K.
Rust or Staining	None
Spalling	None
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None Observed - May be Obscured by water flow
Drain Holes	N/A
c. Discharge Channel	Rocky with large boulders
General Condition	O.K.
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	Majority of Channel has overhanging trees
Floor of Channel	Rocky Floor - O.K.
Other Obstructions	
*Note: Crest of Spillway is approximately 6" below crest of dam. Therefore, part of the dam crest will act as a spillway during flood conditions	

APPENDIX B

ENGINEERING DATA

ENGINEERING DATA CHECKLIST

<u>ITEM</u>	<u>AVAILABILITY</u>	<u>LOCATION</u>
LOCATION MAP	Available	USGS Map
AS-BUILT DRAWINGS	Not Available	
HYDROLOGIC & HYDRAULIC DATA	Not Available	
SOIL BORINGS	Not Available	
SOIL TESTING	Not Available	
GEOLOGY REPORTS	Not Available	
CONSTRUCTION HISTORY	Not Available	
OPERATION RECORDS	Not Available	
INSPECTION HISTORY	Not Available	
DESIGN REPORT	Not Available	
DESIGN COMPUTATIONS	Not Available	
HYDROLOGIC & HYDRAULIC	Not Available	
DAM STABILITY	Not Available	
SEEPAGE ANALYSIS	Not Available	

WATER RESOURCES UNIT
RECEIVED

MAY 5 1980

APR 30 1980

Dept. of Environmental Protection
OFFICE OF THE COMMISSIONER

ANSWERED _____ 36 West Shore Drive
REFERRED _____ Clinton, CT 06413

RECEIVED
Dept. of Environmental Protection

REGISTERED

NO. 140911

April 28, 1980

MAY 5 1980

Commissioner Stanley J. Pac
Department of Environmental Protection
State Office Building
Hartford, CT 06115

Division of Environmental Quality
Office of the Deputy Commissioner

Dear Commissioner Pac:

Thank you very much for your letter of 28 February, 1980. Your conclusion with respect to essential repairs and alterations specified in the Order of Jan. 22, 1979, was clear to us, and we did not undertake such work. I would like to add that I appreciated your sensitivity to our problem of financing, and especially your suggestion of an option for a means for removing potential hazard until repairs can be made.

At a Special Meeting of the Boulder Lake Improvement Assoc. on April 27, 1980, all officers and trustees of the Association reaffirmed that the purpose of the Association is to retain ownership of the lake, and to maintain it as a private recreational facility. We intend--as we always have--to comply with the Jan. 22, 1979 Order as rapidly as possible.

Please note that we have been active throughout the time since the Order was issued. Preliminary work had to await financing from our community last summer and fall. The amount of money raised was insufficient to proceed, based on the cost estimates we had received. Therefore, we looked for alternative solutions (as suggested in my letter to you of 11 Feb., 1980) as well as for an affordable engineer. Your letter of 28 February offered an approach which we have pursued over the past two months, and which we have discussed with a local firm with experience at the Boulder Lake dam.

As a result of this activity, our current plans are:

1. Temporarily lowering or draining the lake appears to be a prerequisite for engineering evaluation, and it also offers a means to remove the hazard of a potential structural failure. At the April 27, 1980 Special Meeting I was authorized to negotiate a contract for lowering or draining the lake with a local engineering contractor.

2. To make a final determination of a procedure for funding at our Annual Meeting, Sunday June 1, 1980.

We have prepared to realize these plans by providing proper access to the beach and dam area. We improved a road leading to the upstream earthen face (beach) of the dam; provided drainage to minimize beach and road erosion, and repaired and extended the upstream beach area with sandbags, stone, and appropriate fill. This work, which involved about 40 tons of material and volunteer labor from Association members, provides vehicular access to any upstream part of the dam. All of this work was conducted in accordance with the relevant Statutes, and involved no essential repairs or alterations to the dam.

We have also investigated taxation authority through State Senator Knous, the Town of Clinton, and the Association's attorney.

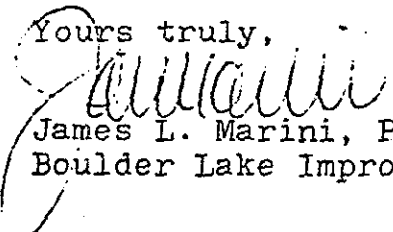
To continue with our efforts to achieve compliance I must request the following:

1. An additional extension of time limits of one year for plans (to June 1, 1981) and one year for completion (to October 1, 1981).

2. Help from your office in providing as complete information as possible regarding permits and other forms of approval required for lowering or draining the lake, particularly with regard to downstream interests. I also want to ask you to use your good offices whenever appropriate to facilitate and speed permits and/or permission from DEP and other agencies or individuals.

I will provide you with additional information you may require regarding our plans and our progress. I hope to demonstrate our credibility with respect to compliance, and hope as well to be able to count on your continued sensitivity to the problem of financing, which ultimately will determine how fast compliance can be achieved.

Yours truly,


James L. Marini, President
Boulder Lake Improvement Assoc.

RECEIVE

FEB 2 1979

36 West Shore Drive
Clinton, CT. 06413
Jan. 30, 1979

FEB 5 1979

ENVIRONMENTAL QUALITY DIVISION
OFFICE OF THE DEPUTY COMMISSIONER

Commissioner Stanley J. Pac
Department of Environmental Protection
State Office Building
Hartford, CT. 06115

Dear Commissioner Pac:

This letter is in response to your letter and Order of Jan. 22, 1979, received by me on Jan. 24 (Cert. No. 136498).

Note that your letter did not include a copy of the engineer's report from a Jan. 8, 1979, inspection of Boulder Lake dam. Please send me a copy of the report at your earliest convenience.

Given that the engineer's report is not available to me at this writing, the following response is necessarily general.

The notification you require is as follows:

1. The Boulder Lake Improvement Assoc., Inc., plans to make the necessary repairs and modifications indicated in your Findings; we do not intend to remove the dam.
2. Pending engineering consultation, we plan to grout the apertures in the masonry which were involved in the leak observed on Jan. 8, 1979; plus ancillary modifications, if indicated by engineering consultation.
3. Pending engineering consultation, we plan to expand the overflow capacity by removing cement blocks from the top of the dam east of the overflow notch; to improve existing overflow capacity west of the notch; and to provide appropriate freeboard requirements in connection with these plans.

For the record, I wish to note that we may have to request an extension of the time limit for completion of repairs (Feb. 1, 1980), in order to take into consideration unpredictable weather conditions.

WATER RESOURCES
UNIT
RECEIVED

FEB 5 1979

ANSWERED 6/4/79 - ext engr. list
REFERRED _____
FILED _____

Yours truly,

James L. Marini
James L. Marini
President, Boulder Lake Improvement
Assoc., Inc.

3. My goal is to submit plans before the end of this year. However, I feel we need the extra time to take into account permits, core sample analysis, and other uncertain factors.

4. We could not expose the leak area before we felt the weather was satisfactory. Hence, there was no way for us to get engineering consultation until recently. We feel that the Order was insensitive to these issues, and should, in fairness, be revised.

C. Temporary repairs.

The existing temporary repairs include sand bags and plastic, most of which were put in place under the direction of the Town Engineer of Clinton. The repairs worked perfectly throughout the last winter, and the materials are regularly inspected and maintained by BLIA. May I stress that any additional costs for new temporary repairs will simply make our financial problems more severe.

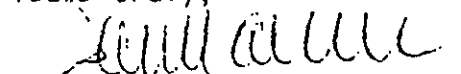
D. Cooperation between BLIA and DEP.

The Boulder Lake community has had to carry on many struggles with Clinton, and local industry, in order to maintain and improve our area. Although we do not relish having to fight for our lake, we are prepared to do it, and there is no way we are going to lose our dam and lake. The more we are forced to spend on attorneys and publicity, the more difficult it will be for us to do what we all--DEP, BLIA, and area residents--want most: to properly repair and improve the dam.

As Commissioner of the DEP I believe you must be one of the people most sensitive to the value of the lake to our community financially and recreation-ally, and most aware of the impact of destroying our lake on the local eco-system. Since our study indicates the possibility of a health problem if the dam is removed, we cannot accept its demolition, the other reasons I've mentioned notwithstanding.

Please meet with us at least half way on this matter, which is of such vital and personal concern to so many of us.

Yours truly,



James L. Marini, President
Boulder Lake Improvement Assoc., Inc.



STATE OF CONNECTICUT

DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATE OFFICE BUILDING HARTFORD, CONNECTICUT 06115

January 22, 1979

Boulder Lake Improvement Assoc., Inc.
c/o James Marini
36 West Shore Road
Clinton, Connecticut 06413

Re: Boulder Lake Dam
Clinton

Gentlemen:

According to records maintained in this office, your association is the owner of the subject dam.

Under Section 25-110 of the 1975 Revision of the General Statutes, a copy of which is enclosed, the Department of Environmental Protection has jurisdiction over all dams "...which by breaking away or otherwise might endanger life or property". The Boulder Lake Dam could cause damage in the event of failure and is therefore under the jurisdiction of this department.

During the heavy rain storm of January 8, the dam was inspected by an engineering consultant retained by our department. The results of his inspection indicate the dam cannot be considered a safe structure in its present condition. A copy of his report is also enclosed for your information.

Since Section 25-111 of the General Statutes states in part: "If, after an inspection described herein, the Commissioner finds any such structure to be in an unsafe condition, he shall order the person, firm or corporation owning or having control thereof to place it in a safe condition or to remove it, and shall fix the time within which such order shall be carried out", the following order is mandated.

FINDINGS

Based on an engineer's report covering the inspection of the Boulder Lake Dam, the Department of Environmental Protection finds the structure to be in an unsafe condition. It also finds that certain repairs or alterations are necessary to place the structure in a safe category.

The repairs or alterations to be made should include, but are not necessarily limited to, the following items:

1. Repair severe leaks through the stone masonry.
2. Provide adequate spillway capacity and freeboard requirements.

ORDER

In accordance with Section 25-111 of the 1975 Revision of the General Statutes, you are hereby ordered to make the repairs or alterations necessary to place the Boulder Lake Dam in a safe category or to remove the structure.

Any repairs or alterations to the structure or its removal shall be carried out in accordance with engineering plans and specifications prepared by an engineer registered in the State of Connecticut and submitted to this department for approval and for the issuance of a permit prior to any construction or demolition work in accordance with Section 25-112 of the 1975 Revision of the General Statutes.

The Commissioner shall be notified in writing within three weeks of receipt of this order what steps you plan to take to repair or remove the structure. Engineering plans should be submitted for the repair or removal of this dam by August 1, 1979 and repair or removal accomplished by February 1, 1980.

Sincerely,

Stanley J. Pac
Commissioner

STP/VFG/dz

Supervision of Dams
Water Resources Unit
Telephone no. 566-7244

SENT CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Enclosures

BUCK & BUCK
ENGINEERS

98 WADSWORTH STREET, HARTFORD, CONNECTICUT 06106

JAMES A. THOMPSON
ROBINSON W. BUCK
LAWRENCE F. BUCK

HENRY WOLCOTT BUCK
1931-1965
ROBINSON D. BUCK
1935-1950

COMM. 5713-138

January 8, 1979

Mr. Victor F. Galgowski,
Superintendent of Dam Maintenance,
Department of Environmental Protection,
State Office Building,
165 Capitol Avenue,
Hartford, Connecticut 06115

Reference: Boulder Lake Dam, Clinton

Dear Vic:

In response to your telephoned request of even date, I inspected the subject dam and herewith report my findings.

I arrived at the dam, with Mr. Sanders of your office, at approximately 11:00 A.M. A local policeman was at the site. He informed us that he had previously attempted to notify downstream residents of possible danger. The water level in the lake had exceeded the freeboard of the service spillway, and water was flowing over the top of the dam, west of the spillway. East of the spillway water was being contained by a row of stone blocks set along the top of the dam.

Approximately twenty feet east of the spillway, and four to five feet below the top of the dam there was a large leak (several hundred g.p.m.). At the top of the dam, just above the leak and upstream of the masonry, a large depression (six feet x ten feet) had formed. Water was flowing into this depression at a high rate, creating whirlpools. Plywood sheathing had been driven into the dam along the upstream edge of the depression and sand bags had been placed in the bottom of the depression. The sand bags and sheathing had been installed before we arrived.

After inspecting the dam, we went to the Clinton Police Department, reported in to you and spoke to Sgt. Kateley of the Clinton Police. We advised him that an attempt should be made to stop the leak. I suggested using layers of polyethylene sheets and sand bags. He proceeded to get the local Civilian Defense people into action.

We then returned to the dam to see if any changes had occurred. It appeared that the leak had increased and the swirling action in the depression had intensified. No one else arrived at the site, so we left at about 12:30 P.M.

* & BUCK

Mr. Victor F. Galgowski

ENGINEERS

PAGE 2.

DATE

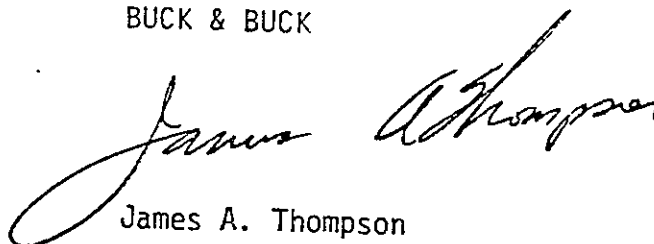
January 8, 1979

COMM. 5713-138

In my opinion this dam is unsafe and I strongly recommend that the owners of the dam be ordered to prepare plans for, and repair this structure as soon as possible.

Sincerely yours,

BUCK & BUCK

A handwritten signature in cursive script, reading "James A. Thompson". The signature is written in dark ink and is positioned above the printed name.

James A. Thompson

JAT:fb

36 West Shore Road
Clinton, CT. 06413

19 June, 1978

UNIT
RECEIVED

JUN 23 1978

Mr. B.A. Warner
Acting Director
Water Resources Unit
DEP
State Office Building
Hartford, CT. 06115

ANSWER _____
REFER _____
FILED _____

Dear Sir,

I am responding to your letter of 6 June, 1978, addressed c/o T. Carmody of the Boulder Lake Improvement Association (BLIA). Please note that future correspondence should be addressed to:

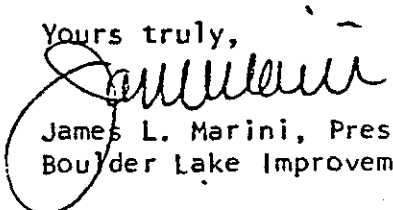
Boulder Lake Improvement Association, Inc.
c/o James Marini
36 West Shore Road
Clinton, CT. 06413

Your letter described the results of a recent inspection of our dam and requested our response. The eroded area west of the overflow notch was filled with approximately one cubic yard of 6"--12" stone on 4 June, 1978, shortly before we received your letter. In the summer of 1977 we placed a layer of similar stone, covered with dirt and sod, into the eroded area in question. The sod was swept away last winter but the 1977 stone base remained intact; we feel that since we have now completely filled the eroded area with stone there is no immediate danger of further significant erosion.

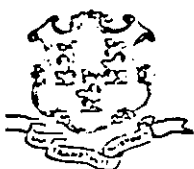
Regarding prevention of further deterioration, we have been actively considering solutions during the past year. A difficulty is that limiting the overflow west of the notch increases it east of the notch, which puts the BLIA beach in danger of erosion.

We therefore wish to request an on-site inspection of our dam by a DEP representative accompanied by BLIA members, so we can work out a solution to the problem and have first-hand information on the best building practices to employ. We look forward to hearing from you at your earliest convenience as to the procedure to follow to arrange such an inspection.

Yours truly,


James L. Marini, President
Boulder Lake Improvement Assoc., Inc.

cc: Victor Galgowski, Supt. Dam Maintenance



STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATE OFFICE BUILDING

HARTFORD, CONNECTICUT 06115

6 June 1978

Boulder Lake Improvement Association
c/o Thomas Carmody, President
33 West Shore Drive
Clinton, Connecticut 06413

Re: Boulder Lake Improvement Association Dam
Clinton

Dear Mr. Carmody:

According to records maintained in this office, the above-mentioned dam is under your ownership.

Section 25-110 (Public Law No. 571, 1975 Revision of the General Statutes), a copy of which is enclosed, places under the jurisdiction of this department all dams, which by breaking away or otherwise, might endanger life or property. It has been determined that this dam is under our jurisdiction.

In accordance with Section 25-111 (1975 Revision of the General Statutes) this dam has been inspected. In order to maintain your dam in a safe condition, the following maintenance work or deficiencies should receive attention:

Recent overflows have eroded material from the top of the dam immediately west from the overflow notch and some of the masonry supporting the concrete notch is missing.

To prevent further deterioration and lowering of the pond, repairs should be made to the masonry and the top of the dam modified to limit the area of overflow.

The Water Resources Unit of the Department of Environmental Protection shall be notified within two weeks as to what steps you plan to take to accomplish this work.

If you have any questions, please contact Victor Galgowski, Supt. of Dam Maintenance, at 566-7245.

Sincerely,

Benjamin A. Warner
Acting Director
Water Resources Unit

BAW:ljg
Enclosure

Interdepartment Message

D-201 REV. 3-77 STATE OF CONNECTICUT
Form No. 693K-1153-01SAVE TIME: *Handwritten messages are acceptable.*

Use carbon if you really need a copy. If typewritten, ignore faint lines.

To	NAME	Victor F. Galgowski	TITLE	Supt. of Dam Maintenance	DATE	15 May 1978
	AGENCY	Environmental Protection	ADDRESS			
om	NAME	Charles J. Pelletier	TITLE	Consultant	TELEPHONE	
	AGENCY	Environmental Protection	ADDRESS			

SUBJECT: Boulder Lake Dam, Clinton

Inspection date was May 11, 1978.

This dam is about 16 feet high at the overflow section and about 230 feet long.

The dam consists of a downstream masonry wall with earth fill on the upstream side. The dam rests on ledge and large boulders. There are two obvious leaks at the base of the dam flowing 1 to 2 g.p.m.

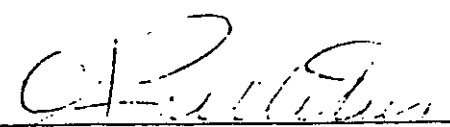
Nominal overflow at the time of inspection was passing through a 0.3' x 5' long notch in concrete on top of the masonry. The top of the dam is irregular - some concrete blocks and some earth fill and masonry.

At times of high flow, water flows over a substantial part of the length of this dam.

Recent overflows have eroded material from the top of the dam immediately west from the overflow notch and some of the masonry supporting the concrete notch is missing.

The probability of a sudden release of a large volume of water by failure of this dam is relatively low. However, further deterioration could release for a short time sufficient flow to fill the brook channel downstream at least bank full.

To prevent further deterioration and lowering of the pond, repairs should be made to the masonry and the top of the dam modified to limit the area of overflow.


Water Resources Unit

CJP:ljc

BIBLIOGRAPHY

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3. Soil Survey, Hartford County, Connecticut, United States Department of Agriculture, U.S. Government Printing Office, Washington 25, D.C. 1962
4. Donald M. Gray: Handbook on the Principles of Hydrology, Water Information Center, 1970.
5. Hunter Rouse: Engineering Hydraulics, John Wiley and Sons, New York, 1950.
6. Victor L. Streeter: Fluid Mechanics, McGraw-Hill Book Company, Inc. 1958.
7. S.C.S. National Engineering Handbook, Hydrology Section 4, Soil Conservation Service, U.S. Department of Agriculture, 1972.

APPENDIX C

DETAIL PHOTOGRAPHS

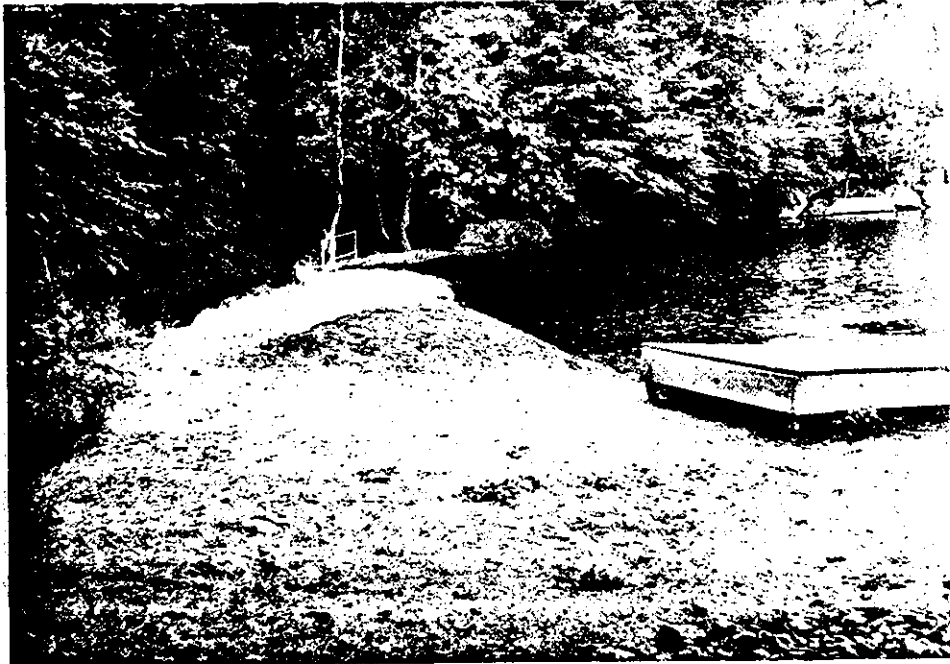


Photo 1 - View along crest of dam looking west.
Note two trees on the crest of dam in
background.

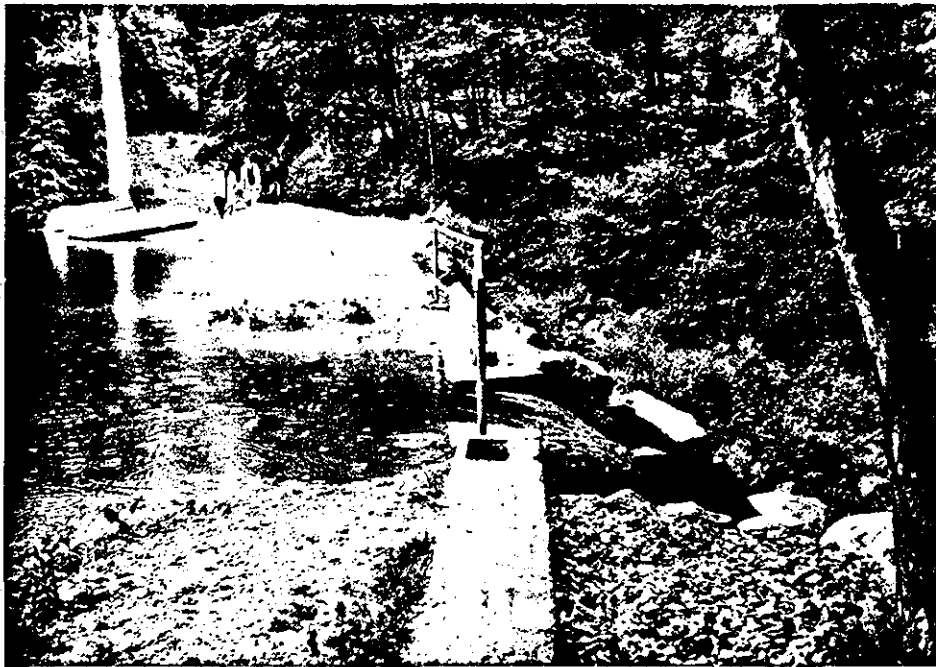


Photo 2 - View of dam, looking east along the
crest. Note spillway.

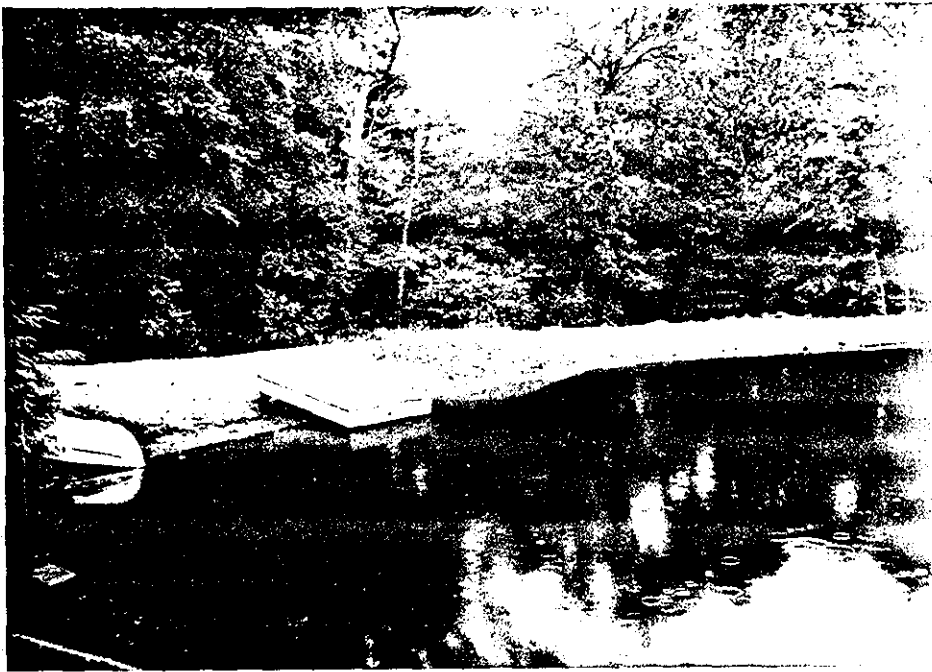


Photo 3 - View of dam embankment looking downstream.

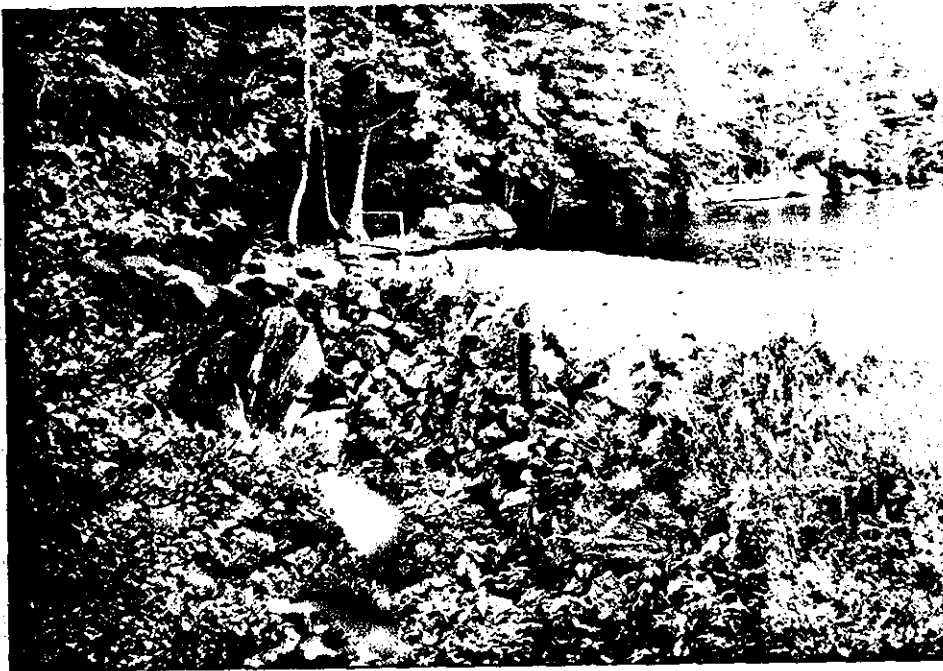


Photo 4 - Downstream face of dam. Note
rubbled stone and boulders

Note: Photos taken
June 2, 1981



Photo 5 - Downstream face of concrete spillway
and dam embankment.

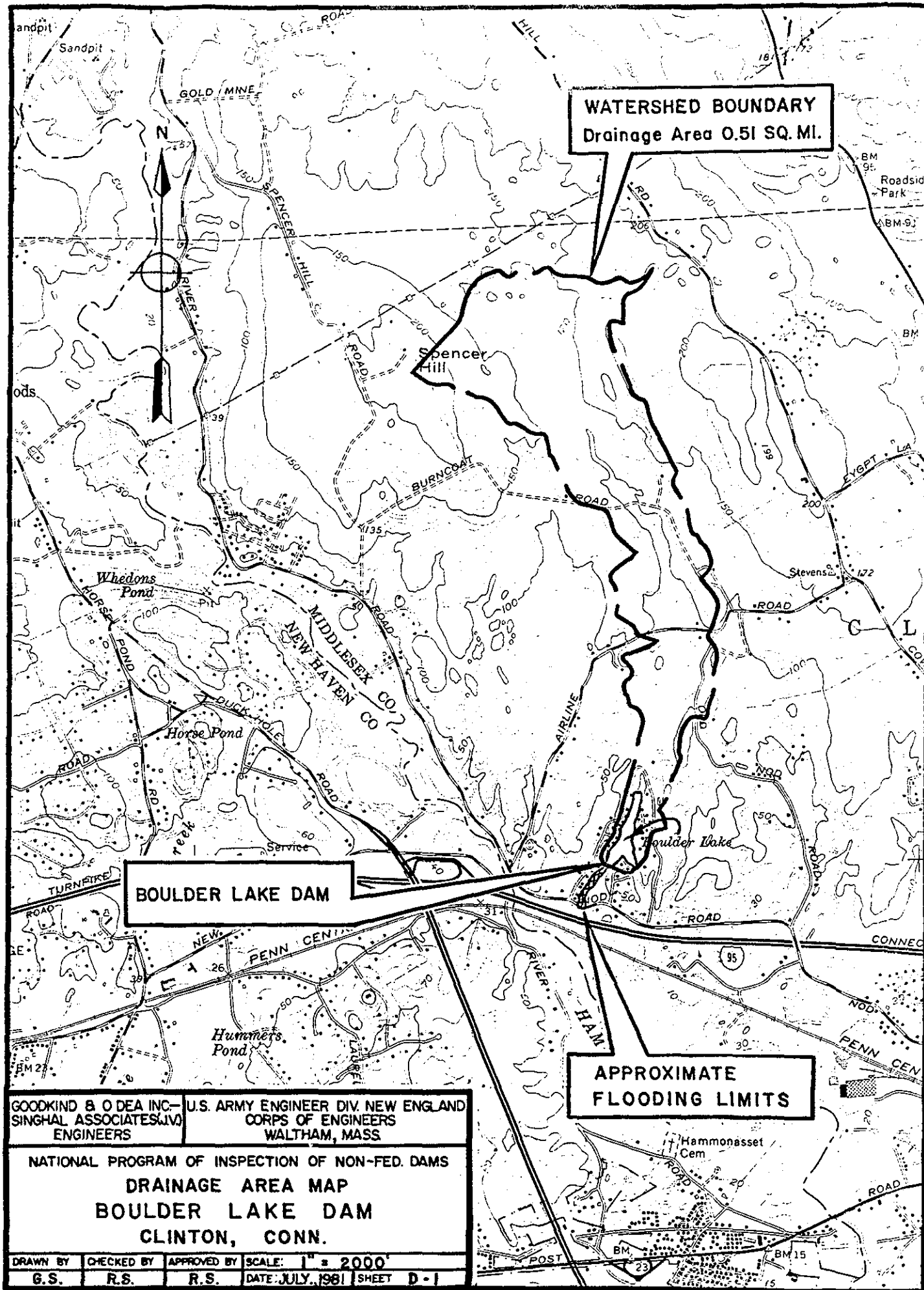


Photo 6 - Upstream reservoir area (Boulder
Lake).

Note: Photos taken
June 2, 1981

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



GOODKIND & O'DEA INC.-
SINGHAL ASSOCIATES, INC.
ENGINEERS

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
DRAINAGE AREA MAP
BOULDER LAKE DAM
CLINTON, CONN.

DRAWN BY	CHECKED BY	APPROVED BY	SCALE: 1" = 2000'
G.S.	R.S.	R.S.	DATE: JULY, 1981 SHEET D-1

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Job BOULDER LAKE DAM

Sheet Number D-1

Date 6-10-1981

By R.S./GS.

TEST- FLOOD

DRAINAGE AREA = 0.50 SQ. MILES (320 ACRES)

THE TERRAIN HAS AN AVERAGE SLOPE OF 1.4%. FROM THE CORPS OF ENGINEERS CHART "MAXIMUM PROBABLE FLOOD PEAK FLOW RATES"

RUNOFF FACTOR = 925 CFS PER SQ. MILE.
(FLAT & COASTAL)

$$\begin{aligned} P.M.F. &= 920 \times 0.50 \\ &= 460 \text{ CFS (SAY 450 CFS)} \end{aligned}$$

SIZE AND HAZARD CLASSIFICATION

MAXIMUM HEIGHT OF DAM = 12.5 FT.

MAXIMUM IMPOUNDMENT UPTO

TOP OF DAM = 51 AC.FT.

THE SIZE OF THE DAM = SMALL

THE HAZARD POTENTIAL = LOW

AS PER TABLE 3, PAGES D-12, D-13 OF THE "RECOMMENDED GUIDELINES FOR SAFETY INSPECTION OF DAMS", THE RECOMMENDED TEST FLOOD
= 50 TO 100-YR FREQUENCY FLOOD

FROM SOIL CONSERVATION SERVICE PUBLICATION
SCS-TP-149 (FOR FLAT SLOPE AND CURVE
NUMBER 65)

100-YR FREQUENCY RUNOFF = 150 CFS.

ACCORDING TO "A FLOOD FLOW FORMULA FOR CONNECTICUT"
- GEOLOGICAL SURVEY CIRCULAR 365

$$Q_{\text{MEAN}} = 0.85 \times 0.5 \times 1.4 \times 52.8 = 31 \text{ CFS}$$

$$\text{AND } Q_{100} = 5 \times 31 = 155 \text{ CFS.}$$

ASSUME TEST FLOOD = 150 CFS

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Sheet Number D-2

Date 6.10.1981

By R.S./G.S.

THE SPILLWAY CONSISTS OF THE FOLLOWING:

1- OVERFLOW SPILLWAY WITH WIDTH = 5 FT.
AND MAX. DEPTH TO TOP OF DAM = 0.35 FT.
(36.43 - 36.08 = 0.35 F)

AFTER THE WATER SURFACE ELEVATION REACHES 36.43, THE DAM ACTS AS AN OVERFLOW DAM,

CAPACITIES AT VARIOUS ELEVATIONS ARE TABULATED BELOW:

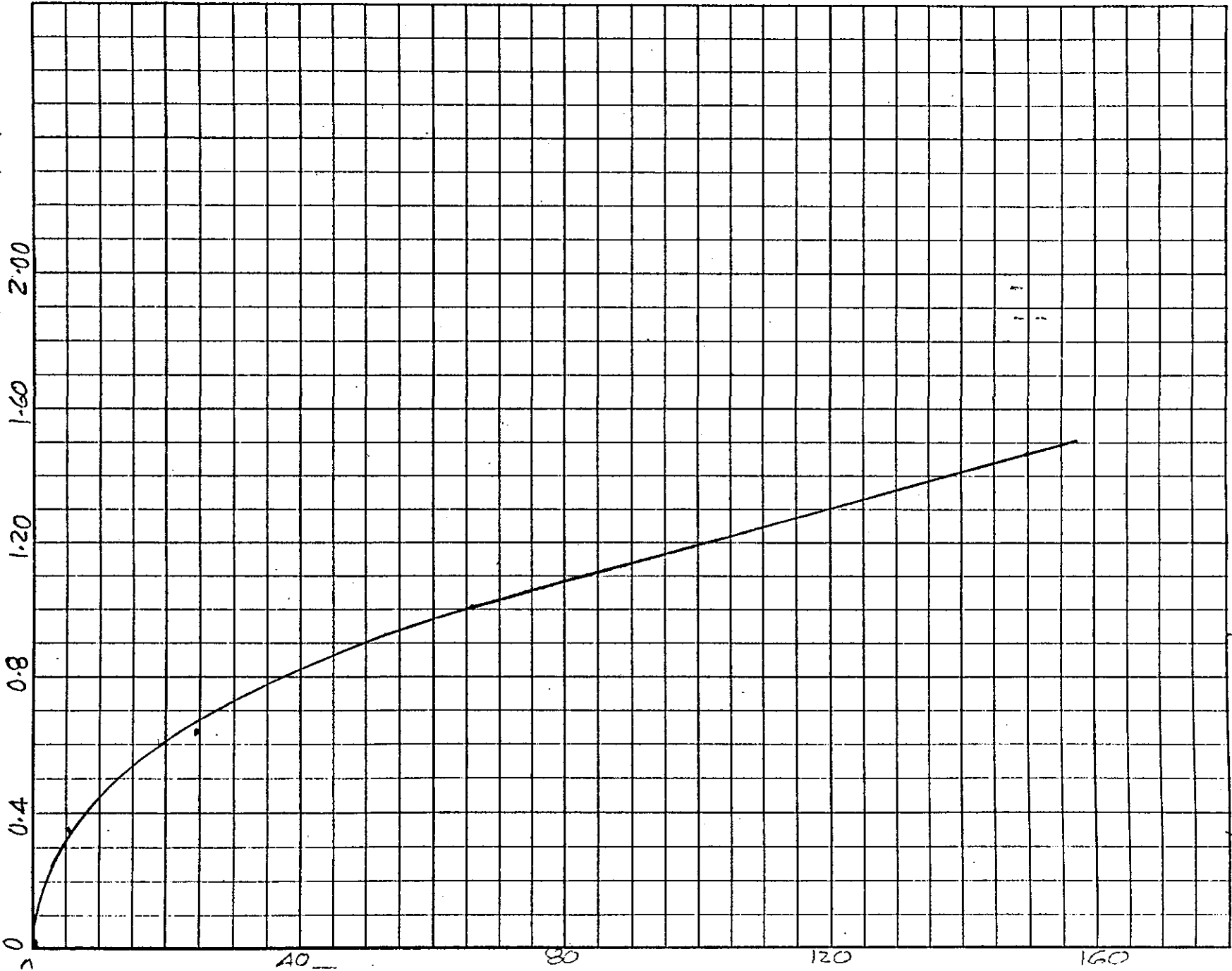
ELEVATION	H (FT).	OVERFLOW CAPACITY (CFS) $Q = 3.0 \times L \times H^{3/2}$
36.08	0	0.0
36.43	0.35 (MAX.)	5.0 (L=20')
37.08	1.00 (Max)	66.0 (L=44')
37.08		
37.50	1.42 (Max.)	150.0 (L=130')

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Job BOULDER LAKE DAM
Sheet Number D-3
Date 7.1.81
By R.S./G.S.

SPILLWAY CAPACITY CURVE



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Job BOULDER LAKE DAM

Sheet Number D-4

Date 6.23.1981

By R.S./G.S.

SURCHARGE STORAGES AND WATER SURFACE AREAS.

LAKE WATER SURFACE ELEVATION	HEIGHT ABOVE SPILLWAY CREST	WATER SURFACE AREA (ACRES)	SURCHARGE STORAGE CAPACITY (AC. FT.)
36.1	0.0	5.9	0.0
37.0	0.9	6.2	5.4
38.0	1.9	6.5	11.65
39.0	2.9	6.8	18.30
40.0	3.9	7.1	25.30

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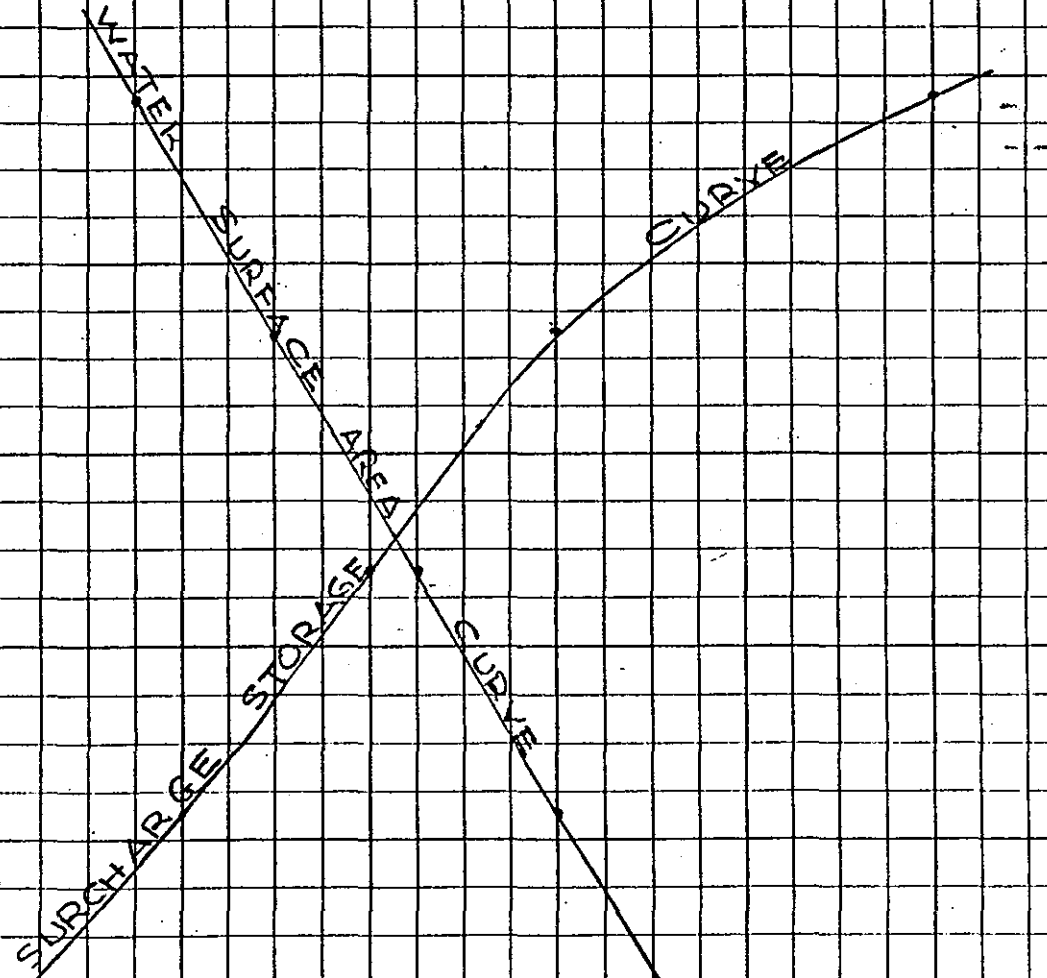
Job BOULDER LAKE D.A.
 Sheet Number D-5
 Date 7.1.1981
 By R.S./G.S.

HEIGHT ABOVE SPILLWAY CREST (FT.)

WATER SURFACE AREA (ACRES)

7.8 7.4 7.0 6.6 6.2 5.8 5.4 5.0

SURCHARGE STORAGE & WATERED SURFACE AREA CURVE



5.0 5.1 5.2 5.3 5.4 5.5 5.6

SURCHARGE STORAGE (AC FT.)

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Job BOULDER LAKE DAM

Sheet Number D-6

Date 7-1-1981

By R.S./G.S.

INFLOW, ROUTED OUTFLOW & ADEQUACY OF SPILLWAY CAPACITY

TEST FLOOD FLOW = 150 CFS.

THE SPILLWAY CAPACITY OF THE 5 FT. WIDE SECTION IS ONLY 5.2 CFS AND THE DAM WILL BE OVERTOPPED.

IN ORDER TO PASS THE TEST FLOOD, THE WATER-LEVEL WILL RISE TO ELEVATION 37.50 WHICH IS ABOUT 1 FOOT ABOVE THE MINIMUM CREST ELEVATION OF THE DAM (36.43). THIS DOES NOT TAKE INTO CONSIDERATION, THE EFFECT OF SURCHARGE STORAGE.

EFFECT OF SURCHARGE STORAGE ON PEAK OUTFLOW

FOR $Q_{p1} = 150$ CFS, HEIGHT ABOVE CREST OF SPILLWAY = 1.0' \pm

AND SURCHARGE STORAGE = 5.9 AC.-FT. WHICH CORRESPOND TO A DEPTH OF

$$= \frac{5.9 \times 12}{0.5 \times 640} = 0.22''$$

$$Q_{p2} = Q_{p1} \left(1 - \frac{0.22}{7}\right) = 150 \times 0.97 = 145 \text{ CFS.}$$

THE AVAILABLE STORAGE IS VERY SMALL AND THE OUTFLOW IS PRACTICALLY THE SAME AS INFLOW.

THE DAM WILL BE OVERTOPPED BY

$$37.50 - 36.43 = 1.07' \quad \text{SAY } \underline{1.0'}$$

THE MAXIMUM SPILLWAY CAPACITY UPTO TOP OF THE DAM EQUALS 5.0 CFS WHICH IS ONLY 3.33% OF THE ROUTED OUTFLOW RATE.

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Job BOULDER LAKE DAM
Sheet Number D-7
Date 7.1.1981
By R.S./G.S.

DAM FAILURE FLOOD ROUTING

STORAGE CAPACITY UPTO TOP OF DAM
= 51 AC-FT.

AS PER CORPS OF ENGINEERS GUIDELINES:

$$Q_{p1} = \frac{8}{27} \cdot W_b \cdot \sqrt{g} \cdot y_o^{3/2}$$

WHERE Q_{p1} = DAM FAILURE PEAK OUTFLOW RATE
IN CFS.

W_b = BREACH WIDTH = 40% OF DAM LENGTH
AT MID-HEIGHT.

y_o = HEIGHT FROM STREAM-BED TO
POOL LEVEL AT FAILURE

SUBSTITUTING THE VALUES OF W_b AND y_o
AS $(0.4 \times 130')$ AND 14 FT. RESPECTIV

$$Q_{p1} = \frac{8}{27} \times (0.4 \times 130) \times \sqrt{32.2} \times 14^{3/2}$$
$$= 4578 \text{ CFS}$$

SAY 4600 CFS.

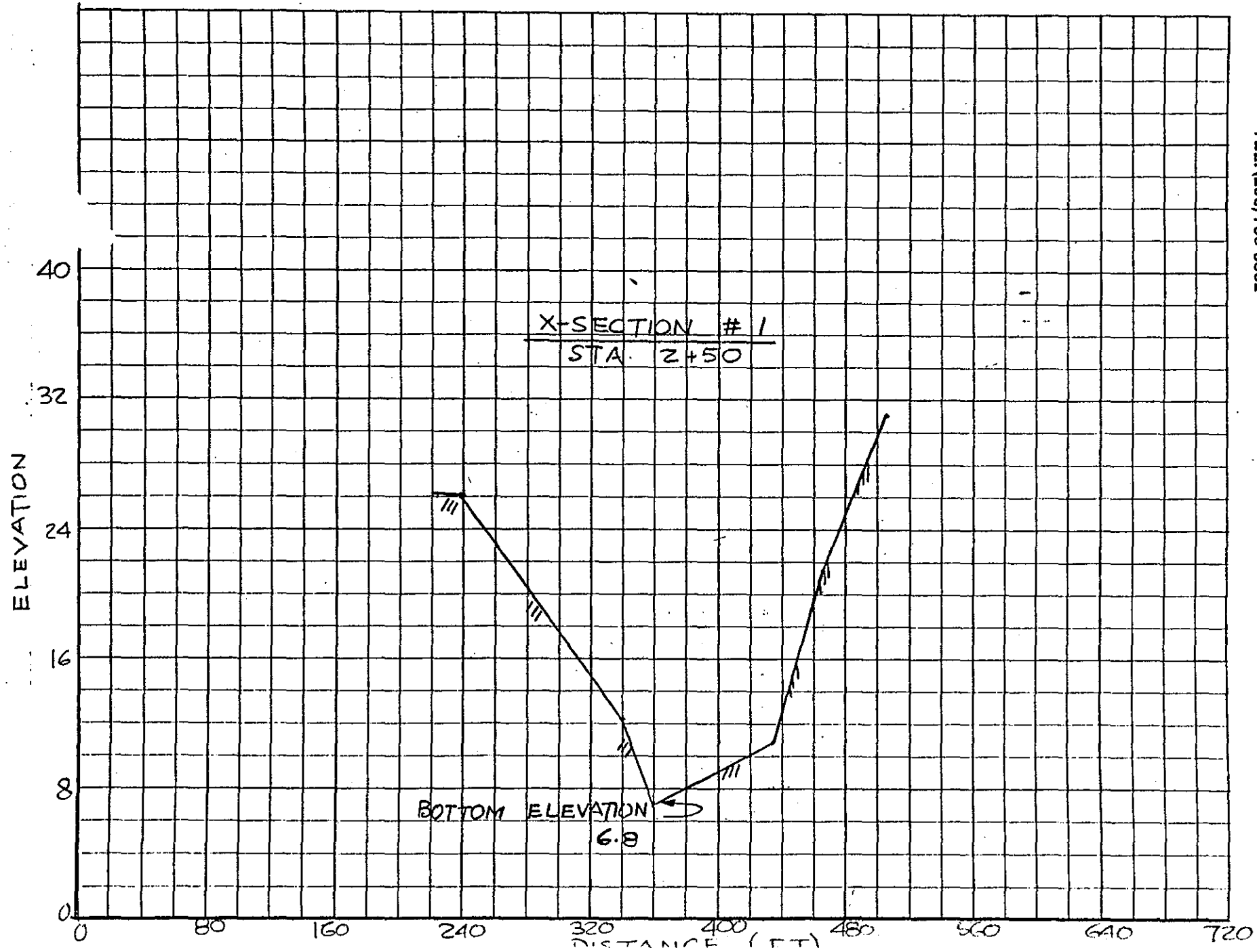
7.1.1981

BOULDER LAKE DAM

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Job BOULDER LAKE DAM
Sheet Number D-8
Date 7.2.1981
By W. S. SINGHAL

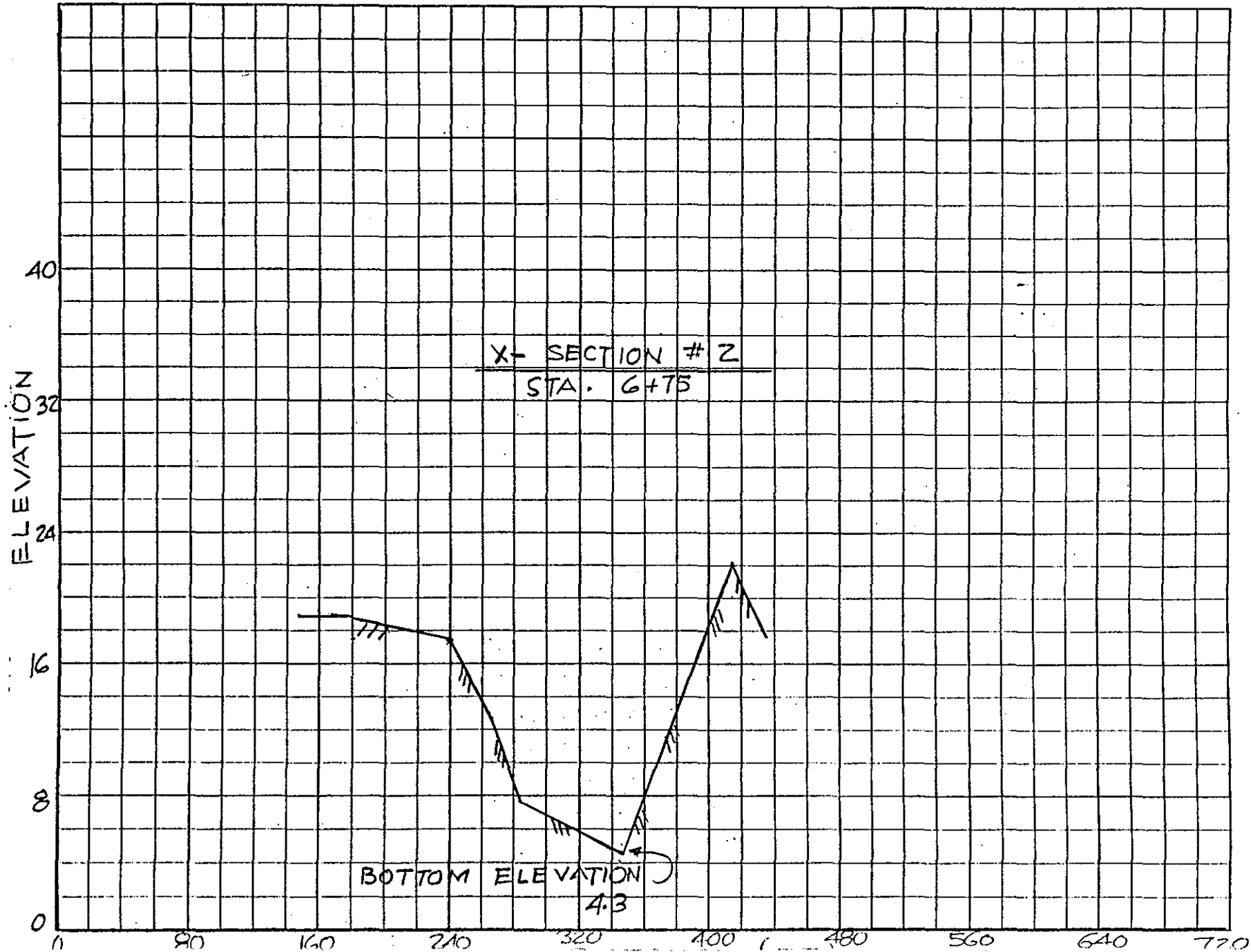


T.1. 1981
BOULDER LAKE DAM

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Job BOULDER LAKE DAM
Sheet Number D-5
Date 7-2-1981
By R.S./G.S.



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X- SECTION #1 STA. 2+50

ELEV.	D (FT)	P _w (FT)	A (SF)	R = A/P _w (FT)	S (FT/FT)	V = $\frac{1.486}{n} R^{2/3} S^{1/2}$ (FT/SEC)	Q (CFS)
10.0	3.2	70	80	1.14	↓	4.64	370
12.0	5.2	94	260	2.77	↓	8.38	2180
14.0	7.2	110	470	4.27	0.01	11.19	5260
16.0	9.2	134	720	5.37	↓	13.03	9880
18.0	11.2	154	1020	6.62	↓	14.98	15280

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Job BOULDER LAKE DAM

Sheet Number D-12

Date 7.2.1981

By R.S. / G.S.

DAM FAILURE FLOOD ROUTING

X - SEC. #1 STA 2+50

FOR $Q_{P_1} = 4600$ CFS.

$H_1 = 6.8'$ AND $A_1 = 425$ S.F.

REACH LENGTH = 250'

STORAGE VOLUME = $250 \times 425 / 43560 = 2.4$ AC. FT.

= 0.008" OF RUNOFF.

$$Q_{P_2} = Q_{P_1} \left(1 - \frac{.008}{7''}\right) = 4600 \times 0.999 = 4595 \text{ CFS.}$$

ROUTED FLOW BELOW X-SEC. #1 WILL BE

$$Q = 4600 \text{ CFS.}$$

$$\text{AND } H = 6.8'$$

$$\text{POST FAILURE FLOOD ELEVATION} = 6.8 + 6.8 = 13.6$$

$$\text{PRE FAILURE FLOW} = 150 \text{ CFS.}$$

$$\text{FLOW DEPTH} = 1.3 \text{ FT.}$$

$$\text{AND FLOOD ELEVATION} = 6.8 + 1.3 = 8.1$$

$$\begin{aligned} \text{RISE IN FLOOD STAGE} &= 13.6 - 8.1 \\ &= 5.5' \end{aligned}$$

NUMBER OF HOUSES FLOODED

$$\text{BEFORE FAILURE} = 0$$

$$\text{AFTER FAILURE} = 0$$

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Job BOULDER LAKE DAM

Sheet Number D-13

Date 7.2.1981

By R.S./G.S.

DAM FAILURE FLOOD ROUTING

X-SEC. #2 STA. 6+75

FOR $Q_{P_1} = 4600$ CFS, $H_1 = 6.35'$ AND $A_1 = 404$ S.F.

REACH LENGTH = 425'

STORAGE VOLUME = $404 \times 425 / 43560 = 3.9$ AC. FT.
= 0.013" OF RUNOFF

$$Q_{P_2} = Q_{P_1} \left(1 - \frac{0.013}{7}\right) = 4600 \times 0.998 = 4590 \text{ CFS.}$$

$$H_2 = 6.34'$$

ROUTED FLOW BELOW X-SECTION #2 WILL BE

$$Q = 4600 \text{ CFS.}$$

$$\text{AND } H = 6.3'$$

$$\begin{aligned} \text{POST-FAILURE FLOOD ELEVATION} &= 4.3 + 6.3 \\ &= 10.6 \end{aligned}$$

$$\text{PRE-FAILURE FLOW} = 150 \text{ CFS.}$$

$$\text{FLOW DEPTH} = 1.7'$$

$$\text{AND FLOOD ELEVATION} = 4.3 + 1.7' = 6.0'$$

$$\text{RISE IN FLOOD STAGE} = 10.6 - 6.0 = 4.6'$$

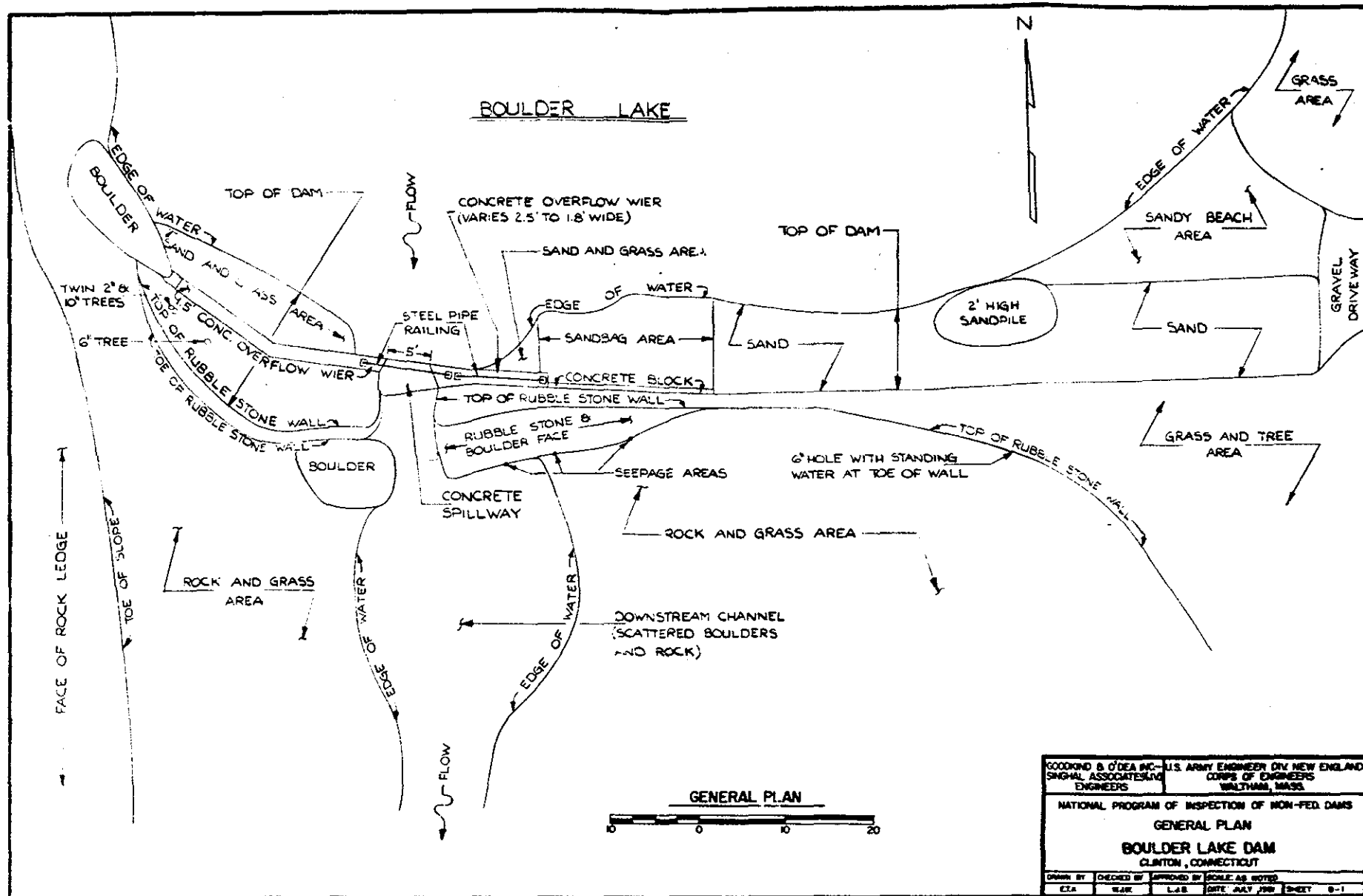
NUMBER OF HOUSES FLOODED

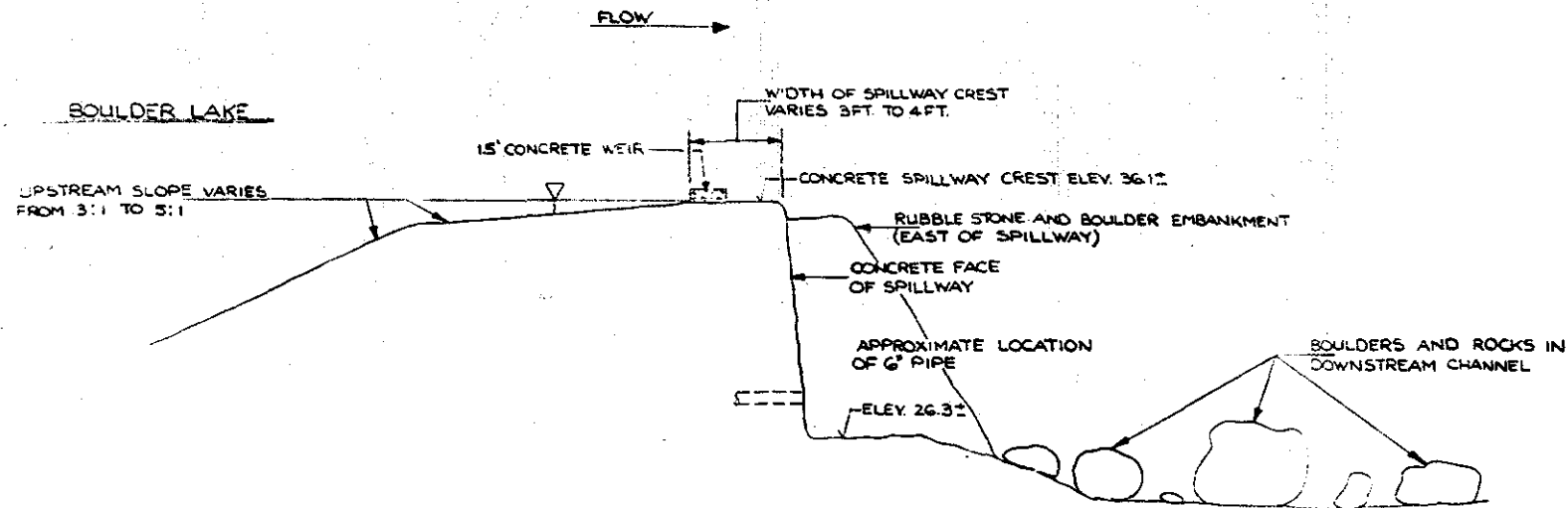
BEFORE FAILURE : 0

AFTER FAILURE : 0

APPENDIX E

INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS





PROFILE OF SPILLWAY



NOTE:
ALL ELEVATION REFERENCED TO MEAN SEA LEVEL.

GOODRIND & O'DEA INC. SINGHAL ASSOCIATES/VA ENGINEERS		U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
PROFILE OF SPILLWAY			
BOULDER LAKE DAM			
CLINTON, CONNECTICUT			
DRAWN BY E.T.K.	CHECKED BY E.T.K.	APPROVED BY L.S.B.	SCALE: AS NOTED DATE: JULY, 1961 SHEET: 8-2

